

## 6.—European man in southwestern Australia

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### Abstract

European man's impact on the south-west of Western Australia may be treated in three periods:

(1) 1829-1850, the period of initial impact. This was characterized by the carrying over of British and European preconceptions in the appraisal of an unfamiliar terrain. Want of labour, capital, and colonial experience led to the simplest forms of adaptation of building and agrarian techniques in the new environment.

(2) 1850-1890, a period of greater prosperity and population growth. The task was envisaged as "subduing" nature and imposing where possible British models of building, landscaping, and agricultural adaptation. Lack of means still led to what could later be considered conservative and exploitative forms of land use.

(3) 1890-1973, initiated by a period of mineral discovery stimulating economic takeoff. This period is marked by increasing urbanization and metropolitan influence on the hinterland, and recently by the uneven growth of a greater official and public recognition of the need for policies of conservation and regeneration.

### Introduction

Historians, economists, creative writers, biologists, naturalists, and agricultural scientists have each contributed to our understanding of the impact of western man on the environment of Western Australia. Unfortunately each discipline has tended to work on its own, sometimes apparently ignorant of advances made in other fields, almost always without the full advantages of an interdisciplinary approach. Of the three standard histories of Western Australia, Kimberley (1897), Battye (1924), and Crowley (1960), Battye shows the least, and Crowley the most appreciation of the environmental and economic factors influencing the spread and character of settlement. All wrote before the rise of the current concern with ecology, and none shows the subtle environmental awareness of a recent work such as W. K. Hancock, *The Monaro* (1972). Consequently an essay in synthesis can attempt little more than to record the various contributions made by contemporary observers and later scholars, and to suggest an immediate and obvious need for future research.

The era of European contact may be divided into a period of pioneering, 1829-50, when the first appreciations and assessments of the terrain took place; a period of consolidation, 1850-90, following the stimulus of convict transportation and the spread and diversification of rural activity; and the modern period, since 1890, when growth reflected the multiplier effect of the gold-rushes.

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### 1829-50: Pioneering

There are as yet no authoritative surveys of the historical demography of Western Australia, although a major project is shortly to be initiated by Professor R. T. Appleyard, under whose supervision current work is in progress at the Department of Economic History at the University of Western Australia. Statham is engaged on a study of the first twenty years of settlement, as a result of which it may be possible to test Kimberley's assertion (*op. cit.*, p. 39) that 'Substantially, Western Australia had for its pioneers more highly educated men of good society than perhaps any other British dependency'. "Musters" or census returns were compiled regularly, from which it would appear that although over 4,000 settlers were attracted to the Swan River Colony by the too-optimistic estimates of Captain Stirling and others, only 1,132 remained in 1830 and 2,311 in 1840. Numbers improved to 5,886 in 1850, in which year convict transportation, rejected by other Australian colonies, was introduced as a stimulus to Western Australia's economy (Gertzel, 1949). Until then, it may be doubted if the white inhabitants of the south-west significantly outnumbered the Aborigines.

The spread of settlement was spasmodic and uneven. The first comers in 1829 sought land which was accessible to sea or river transport and which, so far as possible, met English criteria for desirable farming country. Along the Swan River above Guildford a number of estates still flourishing as vineyards were established before 1840. Much of the coastal sandplain was either alienated to absentees or unsuitable because of what was discovered much later to be deficiency in trace elements. The colony was too isolated and under-populated to generate economic growth (Staples, 1961). The pressure for land led to the early exploration and settlement of the Avon Valley during the 1830s and the Victoria Plains during the 1840s (Deacon, 1947; Erickson, 1971). Itinerant shepherds shifted their flocks frequently, following feed and surface water. Meanwhile Albany on King George's Sound, since December 1826 the site of a convict garrison, became after 1831 another nucleus for free settlement. The Bunbury and Vasse districts, sparsely settled from 1830, received some stimulus from the ill-fated 'Wakefieldian' settlement at Australind in 1840-42 (Shann, 1926; Staples, 1948). Geraldton, founded in 1848, became the base for the occupation of the Champion Bay district (Kelly, 1958). These four centres of settlement—Geraldton, Fremantle/Perth, Bunbury, and Albany—were linked by a coastal shipping service

whose shipwrecks were frequent. Land transport was inhibited by the tracts of dense timber and scrub, or of sandy soil, which separated each nucleus of settlement.

Shortages of capital, labour, and time made for a modest architecture. An authoritative survey is in progress for the early colonial period by Dr John White, Department of Architecture, University of Western Australia. Cameron (1968) following Irwin (1835) notes that a number of the 1829 settlers brought out prefabricated timber houses, which warped in the heat and excessively wet season of 1830. Most early houses were of wattle-and-daub—basketwork plastered with clay—or “ramjam”, a mixture of sand and clay rammed into consistency and bolted at intervals. More substantial buildings were later constructed of locally-made brick or (in the Fremantle area) of limestone. Jarrah and sheoak shingles gradually replaced thatch as a roofing material (Bunbury, 1930). Verandahs were not common inland, but were a feature of Perth and Fremantle houses (Ogle, 1839). Most public buildings retained a modified Georgian idiom until the 1850s, sometimes with unfortunate effects, as with the heavy Grecian portico of the first Anglican Church, more often with a simple elegance, such as the Old Court House of 1836, or the Chapel of the Children of Mary of 1846 (Oldham, 1961). The cities of Perth and Australind were both laid out on the formal, rectangular pattern preferred by early 19th century town planners (cf. Adelaide, Melbourne). Bold (1939) regretted that opportunity was not taken to lay out the city around the contours of the many swamps and lakes then existing north of the Swan, but Roe, the first Surveyor-General, seems to have considered that the uneven and dissected terrain presented sufficient difficulties without embarking on town-planning experiments (J. B. Roe, 1927).

This raises the question of how the first settlers perceived their environment. Their first expectations were shaped by European experience. Cameron (1970) points out that as a naval man Stirling judged the potential of the Swan River in terms of trade, strategy, and anchorage:

He found difficulty in translating what he had seen into meaningful terms, and had resorted to comparisons of the Swan River with Virginia and the Plains of Lombardy. Both these comparisons no doubt raised entirely different ideas in the minds of his readers than he intended. Their frame of reference was somewhat different from his.

As the hinterland was penetrated some settlers viewed the new environment with nostalgia for the past, others with an appreciation of its differences. Following Dale's expedition of 1830 to the Avon Valley, Clarkson and Hardey named the district “Yorkshire” from a fancied resemblance to their native county (Deacon, 1947). On the contrary James Henty, on a separate expedition about the same time, saw the Australian bush as *sui generis*:

The grandeur of the scene among the valleys surrounded by increasingly tall white gums and the solemn silence prevailing in the bush, totally unaccompanied by any signs of civilization, imparts ideas that it is impossible to reflect on without awe and reverence and

which those who have not experienced it can scarcely appreciate (Bassett, 1954).

This sort of reaction was none too common. Most observers, even after a dozen years of settlement, still used the English landscape as a standard of comparison, while some such as Wollaston (1948) needed time to realize that appreciation of the Western Australian bush required the newcomer to divest himself of preconceptions. He found the trees stunted and sombre, and most praised those Australian trees such as the peppermint which reminded him of European foliage. Some, however, such as Georgiana Molloy, were captivated by the Western Australian wildflowers:

It is to be regretted that the flowers of this country are so uncommon in England, as were they imitated in that beautiful work of art, artificial flowers, they would create a great rage. They are so well calculated from their size for that work, also the brilliancy of colour could well be imitated in the manufacture of porcelain and china . . . (A. Hasluck, 1955)

Because there was no assured water supply and little labour, even the most nostalgic settlers could not hope to recreate an English landscape in Western Australia. An article in the *Perth Gazette* (9 March 1833) listed fruit-trees and bushes introduced and already “flourishing”. Most were Mediterranean or tropical: grape vines, two varieties of fig, peach, almond, several varieties of apple, pear, strawberries, aloes, several varieties of plum, four varieties of olive, mulberry, pineapple, plantain, sugar-cane, flax-lily and Cape gooseberries. Alfred Stone, builder of the first cottage in St. George's Terrace, planted a geometric layout of olives and vines behind his house and a selection of “natives” in front, including *Nuytsia floribunda* and various “mahogany” trees (Oldham, 1961). The Benedictines at Subiaco also planted olives. It is known that Norfolk Island pines and Moreton Bay fig were planted in Perth at this period, and the cypress was probably introduced before 1860.

In a recent Flinders University honours thesis Moon has appraised the attitudes to the rural environment of South Australian colonists. It is probable that a similar detailed study of the attitudes of Western Australian colonists would lead to the same general conclusions.

. . . . (the grasses and the trees) . . . were mostly utilized in their natural state, little attempt being made to improve, or conserve their value as a resource . . . the trees were generally tried, found wanting, and consequently cleared away as much as possible.

The early nineteenth century Englishman, reacting against the immediate horrors of industrialization, created the myth of a rural Eden which was certainly far from the reality of the pre-industrialized rural life. The early colonists would have found the strange Australian environment difficult enough to appreciate even if their attitudes had not been partly shaped by such a myth. Their attitude, as Moon has shown for the South Australians, was too often one which later generations would see as exploitative. It is an attitude which still persists amongst many. In any case, with so much virgin bush around them, the early settlers would not have seen any need for reserves. The

first reserves were set up under the Land Regulations of 1872 and 1887, though they lacked legislative security (Australian Academy of Science, 1962).

There can be little doubt that the Aborigines also exploited the environment beforehand and Merrilees (1968) and Hallam (1971) have discussed the significant effect of the use of fire by them. Hancock (1972) also discusses similar studies of the effect of fire in south-eastern Australia. However, there seems to have been too little research on the comparative effects of naturally-occurring fires, Aboriginal fires and the fires of the European settlers. Hallam draws attention to the relative infrequency of fire due to lightning strike. However, the Western Australian flora displays many adaptations to fire and these adaptations may have required a longer time span than that now suggested for Aboriginal occupation. Further research may reveal that this time span was in fact sufficient for man-made fire to be effective. Some of these adaptations may have evolved in response to increasing aridity, and it may be impossible to separate the effect of fire and climate. Gardner (1957) argues for the primacy of fire as a factor and suggests greater frequency of "natural fires" caused by lightning strike, but on more subjective evidence.

Man's use of fire may have affected principally the distribution of species, both of plants and animals. It would be interesting to know in more detail the different results of the varying practices of the European and the Aborigine. It is possible that the European use of fire has been more destructive, because of the altered pattern and greater frequency of burning, settlement in fixed locations, and because of the more intense pressure of a greater population. Hatch (1959) and Wallace (1966) have discussed the effect of post-settlement fires in the jarrah forests, while Gardner (1957) examined the effect of fire on the whole flora. It is hoped that current research by forestry scientists will greatly improve our appreciation of the role of fire in environmental management. It may be too late, however, to study in detail the relative effects of Aboriginal and European practices.

Fire is only one of the factors that changed significantly when the Europeans arrived. It appears that the grazing habits of sheep, for example, very quickly altered the distribution of native grasses. There appear to be fewer local contemporary observations than Hancock could draw on for his Monaro study. Cattle and goats have, in their own ways, been destructive of the environment, particularly in a region where fresh-water sources are relatively thinly distributed. Introduced animals have to concentrate near these sources, whereas the native animals have adapted to be independent, or less dependent, on direct water supplies.

Popularly the introduction of the fox and the rabbit have been recognized as environmental tragedies. However, except for a colony of rabbits on Carnac Island (Moore, 1931) neither was introduced into Western Australia before the 20th century. Because of sentiment there has

been far less popular recognition of the great impact of the cat and the dog on marsupial fauna. The descendants of European dogs "gone bush" were also probably more often responsible than dingoes for attacks on sheep. At the same time native species of animals and birds were assumed, sometimes quite falsely, to be vermin, and this led to unwarranted destruction.

Introduced pathogens are part of the total impact on the environment, although in the earlier years of the colony the long ocean voyage may have been an effective quarantine against the introduction of plant and animal disease. It has nevertheless been speculated, for example that 'jarrah die-back disease' may have been introduced with plants brought by the colonists (Newhook and Podger, 1972). Scab was intermittent among sheep from its first introduction from Van Diemen's Land in 1831 to its gradual eradication around 1900 (Deacon, 1950; Cranfield, 1959). Another early setback to pastoral settlement was the presence of native poison plants, leguminous pea-flowered bushes which to an unaccustomed European eye might look like good grazing. Drummond in 1840-41 identified the York Road poison (*Gastrolobium calycinum*), and other gastrolobia were later brought under suspicion (Erickson, 1959).

Farming practices were at first of necessity poor. Bunbury in 1837 censured the Avon Valley settlers for slovenly farming, deploring especially the habit of broadcasting seed among the old stubble of last year's crop. From an early period agricultural associations were formed at Perth and York to encourage improvement, and Hutchison is at present undertaking a study of 19th century farming techniques which should lead to a more accurate, and possibly more favourable, assessment of the performance of Western Australian settlers by contemporary standards.

#### 1850-90: Consolidation

The coming of convict transportation in 1850 gave the expected stimulus to Western Australia's growth. From 5,886 the Anglo-Australian population rose to 25,084 in 1870 (Gertzel, 1949). With the ending of transportation a period of recession and near-stagnation followed, but from 1882 the growth of population again accelerated, to reach 48,502 by the attainment of self-government in 1890. Increased contact with the outside world brought to the colony diseases from which it appears to have been previously immune. Research now nearing completion by E. J. P. Joske should throw light on the first decades of the colony's medical history (M.A. thesis, Department of History, University of Western Australia). An outbreak of measles in 1860-61 attacked Aborigines and young children with particular severity as did another in 1883. Infant mortality was high throughout this period; between 1860 and 1870 nearly 45 per cent of all deaths were of children under five (Knight, 1871). Diphtheria, first reported in 1865, was prevalent thereafter. Typhoid was reported several times between 1872 and 1900,

though it was not until 1889 that the common 'colonial fever' was identified by Dr Adam Jameson as a form of typhoid (*Inquirer*, 3 April 1889). Sanitation was primitive; it was not until 1888 that even the city of Perth could boast a system of nightsoil collection, and though improvements followed fairly rapidly in the city, conditions were less good in country and gold-fields districts.

European penetration inland was extensive but very sparse during the period between 1850 and 1890. The activities of sandalwood cutters from about 1845 resulted in the pioneering of a number of tracks which almost certainly followed Aboriginal routes, and would in turn be followed and developed during the great period of goldrush expansion in the 1890's. Improving wool prices and the availability of convict shepherds encouraged the eastward thrust of the pastoral frontier, and by the mid-1860's much of the present wheat-belt was held under grazing leasehold; but because of impermanent water and transport difficulties, very few improvements resulted. From the 1860s pastoral expansion was directed to the Gascoyne, north-west, and Kimberleys. One effect of this spread of settlement was the destruction of habitat and near-extinction of some local fauna. The noisy scrub-bird was believed extinct after 1889, but has recently been located at Two People Bay, east of Albany.

Rowley (1942) and Mouritz (1964) have discerned four major regions of closer settlement in the period between 1860 and 1890. The Irwin-Greenough district and the Avon Valley were the habitat of the "yeomanry", grain farmers on small acreages. The Swan coastal plain was mainly devoted to "kitchen gardens" and vineyards. In the fertile valleys of the south-west, such as the Preston, the Capel, and the Blackwood, the "bush grazing" of sheep and cattle was supplemented by occasional fruit-growing for local markets. Meanwhile from about 1850 a demand for local hardwoods, "Western Australian mahogany", led to the clearing of some stands of jarrah in the south-west (Stewart, 1948; Robertson, 1958).

At first sight, the effect of these developments on the Western Australian environment seems meagre. Only 132,000 acres were cleared by 1890, understandably in view of the density of the timber in much of the south-west. The typical homestead was sited in a clear patch of land surrounded by a huge area of bush. Fencing was slow to spread. Although some paddocks were enclosed in the Toodyay area as early as the 1850s, fences were not common in the Williams district until after the establishment of a road board in 1877; while in the impoverished Irwin-Greenough district even after fencing became compulsory by the Land Act of 1887 the usual expedient was wattle fencing which rotted quickly, as there was no money for any other (Erickson, unpublished; Chate, 1953; McAleer, 1956). In the Hay River district sheep were folded in hurdles: "Their stay in one fold position was largely determined by the deposit of manure within and the condition

of grazing without' (Sten, 1943). In the Harvey district problems of soil and water led to a cycle of grazing between coastal homesteads and out-stations towards the Darling scarp (Staples, 1947). There is indirect but suggestive evidence that grazing practices during the 19th century led to environmental deterioration. Deacon (1950) noted the belief of farmers in the Manjimup district that frequent fires had promoted the growth of scrub and undergrowth. Giles (1950) noted the presence of severe soil erosion and evidence of over-cropping in the long-settled districts of the Avon Valley. Sten cites a Hay River property occupied by one pioneering family for 72 years after 1855, during which time no more than 160 acres were cleared. By 1927 the native grasses were largely eaten out; attempts to introduce prairie grass, timothy, white clover, and other exotics had largely failed; the land was neither rested, ploughed, nor fertilized. Of the owner for much of this period Sten wrote: 'He makes no claim to have improved his property outside the homestead and the dividing fences; he even possibly feels a little contemptuous of those who have expended so much capital and have perhaps less ready cash than himself. His aim was to acquire land free of debt . . .'. It is probable that such an attitude towards investment was common. Reliance was placed on hard work and the recuperative properties of the land. Economic necessity fostered this attitude. One pioneer family in the Kojonup district began farming in 1851 with five sons, two daughters, '17 6 in cash after our journey, two mares, one cart and three dogs on which we depended to catch kangaroos for our own use and the skins to provide us with what else we required. We also had two spades, three grub hoes and two sickles' (Bignell, 1971).

Such small beginnings offered little protection against adversity. In the Harvey district the absence of good communications obliged farmers to resort mostly to subsistence agriculture. There was little margin of resilience against natural hazards. Thus in the Irwin-Greenough district a promising settlement of small farmers on tillage blocks was severely checked by outbreaks of rust in wheat from 1865. Contemporary observers (e.g. Trollope, 1873; the Venn Commission, 1887-90) criticized the backwardness of these farmers, but in fact most were in debt to the Geraldton merchants and storekeepers who would make no advances for improvements. Fallowing was not practised because of wind erosion. Technology improved slowly. Reapers and binders were not commonly in use until the 1890s, and in many parts of the colony flails and scythes were still in use (McAleer, 1956; Kelly, 1958; Cranfield, 1959). Although from the 1870s guano deposits off the Western Australian coast were systematically exploited, local farmers did not consider it highly as a fertilizer, and made little attempt to seek out alternatives. Water conservation was not extensively practised, so that in the York district in the dry season of 1877, farmers had to cart water up to fifteen miles, though the severity of that drought and of others during the late 19th century has

been subsequently exaggerated. Some landholders such as Bishop Salvado practised extensive well-sinking (Dom William, 1961), at times exploiting earlier Aboriginal watering-places. In assessing the "conservative" performance of Western Australian farmers, it should be remembered that farmers in England were also very slow to adopt new machinery, even though they had readier access to manufacturers. Many colonists had not built up enough cash capital, and the scale of operation of many farms may not have been large enough to warrant mechanization. This question requires closer research.

The modest circumstances of most farmers limited the possibilities of vernacular architecture. Many settlers began with a bark hut, graduating later to either a white-washed abode house, "with mud walls a foot thick", or to a pit-sawn timber cottage. Roofing materials were either rush thatch or jarrah shingles. Verandahs became relatively common (Hillman and Norrish, 1938). A significant change came in 1879 with the introduction of galvanized iron. Its use for housing and roofing followed almost immediately in the Perth-Fremantle area. Little opportunity existed for planned landscaping, though mention must be made of the enlightened policies of Maitland Brown, resident magistrate of Geraldton in the early 1870s, who confronted by the encroachment of sandhills on the town area, employed the out-of-work Greenough farmers in a systematic and extensive plantation of native trees all round the outskirts of Geraldton (Farrelly and Maley, 1927). Meanwhile public buildings were erected on a more opulent scale, especially during the period of convict transportation. In Fremantle the use of limestone and an occasional hint of Cape Dutch influence gave individual character to such buildings as the Asylum (now the Fremantle Museum). In Perth the favoured medium was a brick provincial Gothic, often reflecting a strong Tudor or 'Flemish' influence, as with the Perth Town Hall, Wesley Church, and the Cloisters (Oldham, 1961). Private housing also reflected the growing opulence of some citizens, not only among the town residences of notables along Adelaide Terrace and Mount Street, but even in one or two country houses, such as Faversham House at York, where an attempt was made to reproduce the idiom of the English villa.

The diffusion of English culture and the stimulation of the Western Australian economy both depended on improved communications. Convict road-building gave Perth an adequate link with the Avon Valley and Albany, but railways were essential. The first public line from Geraldton to the base-metal centre of Northampton, was not opened until 1879. During the 1880s Fremantle and Perth were linked to the Avon Valley towns. Private entrepreneurs working on the land-grant principle were able to plan more boldly, building a line to Albany by 1889 and projecting another to Geraldton (Bolton, 1958; Manford, Ph.D. thesis, submitted 1973). The coming of the railway would provide primary producers with access to markets and

facilitate the introduction of wire fencing, galvanized iron, fertilizer, and other products which would transform the face of the Western Australian landscape.

### 1890-1973: Modern period

Western Australia was transformed by a series of gold discoveries beginning in a small way in 1885 and culminating in the Coolgardie-Kalgoorlie-Boulder finds of 1892-93. Demographically the "ancient colonists" were swamped by newcomers, mainly from Victoria and South Australia. These men and their families accounted for most of the increase from 48,500 in 1890 to 180,000 in 1900. Because of the consequent natural increase, reinforced by British migration, the population went on rising to 331,000 in 1920 and 432,000 in 1930. Depression and war then checked the rate of increase, but in 1946 the figure stood at half a million, and by 1973 exceeded a million—a more rapid growth than that of the rest of post-war Australia, though stimulated by the same ambitious programme of European migration.

During the whole of this 20th century increase it was remarkable that the area under white settlement in Western Australia did not expand significantly, and in some areas contracted somewhat. Gold pushed the eastward frontier of settlement forward during the 1890s to a line east of Sandstone, Kurnalpi, and Esperance, but except for the Kalgoorlie-Boulder regional metropolis and a few outposts such as Norseman, Menzies, Leonora and Laverton, the continuity of settlement depended on other industries: wool (sparsely), agriculture (to the 10-inch isohyet) and, more recently, base metals such as iron ore and nickel. It was nevertheless the gold-rush of the 1890s which prompted a bold policy of public works. The Coolgardie pipeline completed in 1903 brought an assured water supply to the Eastern Goldfields and the intervening farming districts. The railways linking the newly settled districts to Perth provided access to markets and to imports from outside Western Australia. The completion of Fremantle Harbour in 1897 encouraged regular shipping services, and the advent of a federated Commonwealth in 1901 ensured that Perth, open to outside competition, would produce few of the manufactures required for its own hinterland. Thus the pattern was established under which Western Australia's role was seen mainly as that of an exporter of primary produce, industrially backward and technologically dependent on outside skills.

Between 1900 and 1930 the three major rural areas were (1) the timber and dairying districts of the lower south-west (2) the mixed farming districts of the Avon Valley and the upper Great Southern and (3) the wheat-belt. It was the wheat-belt that dominated the planning of the Western Australian economy. The introduction of "dry" wheat facilitated the occupation of the 200 miles east of the Avon Valley. The "wheat-belt" extended from within five miles of the Murchison south-east to Southern Cross, then south to Hyden and Gnowangerup, for much of

its length paralleling the 10-inch isohyet and the rabbit-proof fences erected in the early years of the century to stem the invasion from the Eastern States. Light railways and the ready availability of public finance stimulated agricultural settlement, even though the lack of surface water and of dams exacerbated the drought seasons of 1911 and 1914. Between 1900 and 1930 the area cleared of timber increased from 3.440,000 to 11.8 million acres, and the area under crop from 201,000 to 4.8 million acres. In 1930-31 the wheat harvest reached 53 million bushels, a figure unsurpassed for thirty years. Despite the establishment of a Department of Agriculture in 1898, this growth was largely without scientific foundations. Most settlers identified soil types by the characteristic vegetation, e.g. morrell gum soil, heavy gimlet soil, York and jam soil (Schapper, 1955). Soil erosion was discerned as a problem in the Geraldton coastal districts as early as 1901. The planting of rye grass was recommended as a palliative, but no mention was made of altered farming methods as a means of preventing erosion (*Jour. Dept. of Agric.* 1901). Scientific soil analysis was first attempted by Teakle in 1929 in an attempt to solve the problem of poor crop yields in the Salmon Gums area, but his findings of excess salinity were at first disputed by "practical" farmers and politicians. It was only with the collapse of wheat prices in the depression of the early 1930s, followed by the extensive abandonment of marginal farms, that value came to be placed on the research of agricultural scientists. The same applied to the dairying industry of the lower south-west where the group settlement scheme of the 1920s was based on the fallacious assumption that country supporting tall timber must be capable of pasturing dairy cattle tended by recently-arrived British migrants. Here too the failure rate was high (Hunt, 1958).

The 1930s saw the first break-throughs in the scientific appreciation of Western Australia's agricultural potential. Underwood (1935; 1972) showed that the 'Denmark wasting disease' in cattle, and other symptoms of wastage and infertility in livestock pastured in the coastal districts, were due to a deficiency in trace elements such as cobalt. Copper deficiency was found to cause neonatal ataxia in lambs (Bennetts, 1937). Teakle (1938) published the first comprehensive soil survey of agricultural regions in Western Australia, and Gardner (1942) definitely identified the three main vegetative forms of the wheat-belt: sand-heath, savannah woodland (York and jam gum country), and eastern sclerophyllous woodland (mallee and salmon-gum country). Meanwhile in an early study of farming practices Roberts (1942) showed that attempts at mechanization—specifically through the use of tractors—often failed because operation was neither efficient nor economically planned. This lay some stress on the quality of farm management, a factor to which greater attention would be devoted after the Second World War.

The years from 1930 to 1945 laid great burdens on the farmers. Apart from the depression, followed by the shortages of labour and materials in the Second World War, there were natural hazards: plagues of emus in 1927-29 and 1932, grasshoppers for several years in the mid-1930s, dry seasons in 1936, 1938, and especially 1940. Though unwelcome, the spread of foxes was thought to check the incursions of rabbits. Quarantine measures mostly prevented the introduction of exotic stock diseases, such as the tick fever common in the Kimberleys, but in 1923-24 there was a short-lived outbreak of rinderpest near Fremantle. However 'toxic paralysis', a form of botulism in sheep first reported in 1927, was responsible for the deaths of 10,000 sheep in the summer of 1932-3. The introduction of subterranean clover was hailed in the 1920s as an important contribution to pasture improvements. However it came under suspicion during the late 1930s and early 1940s as responsible for a serious fall in lambing percentages. This was later shown to be due to the oestrogenic action of the plant (Bennetts, Underwood, and Shier, 1946; Bull, 1972). All these problems were identified and countered by agricultural scientists, but they were not always made use of by the farmers, who with their bitter experiences of debt were naturally wary about investment in improvements, or even about departure from established practice.

Among those farmers who survived, these pressures led to changing policies. Wheat gave way partially or wholly to sheep in some districts. Farms were enlarged and amalgamated. With returning prosperity after 1945 these larger units were better able to make effective use of tractors, combine harvesters, and other forms of mechanization. In the drier wheatgrowing districts (e.g. Burracoppin) the average size of farms doubled between 1940 and 1960 to from 1,500 to 3,000 acres. Productivity was established to be lower on smaller holdings. The rotation of crops was modified so that cropping for wheat tended to occur less frequently on any one piece of land. Despite improved farming practices wheat yields failed to increase significantly, and while controlled experiments failed to produce irrefutable proof of declining soil fertility, the circumstantial evidence was increasingly strong. Soil erosion was identified in long-settled districts such as the Avon Valley. Nevertheless in this and in other regions of higher rainfall a concerted policy of pasture improvement was followed to intensify sheep grazing under the stimulus of buoyant wool prices in the late 1940s and early 1950s (Schapper, 1955; Mouritz, 1964).

One response to improving conditions was the renewed expansion of rural settlement. During the 1950s and 1960s the previously unexploited "light lands" to the east and south of the old wheat belt were brought under cultivation. Official policy aimed at the yearly alienation of a million new acres for agriculture—usually at the expense of the pastoralists—and stimulated clearing by the incentive of tax concessions. The area under wheat reached a maximum of

7.3 million acres in 1968-69, and the harvest of that year attained a record of 112.4 million bushels. A rural recession in 1969-70 provoked some doubts about the continuing wisdom of these trends. 'The time is fast approaching when the only virgin bush left in Western Australia will be that which has been deliberately reserved for conservation' (Ride, 1968). Hogstrom (1968) estimated that in 1965 there remained 11.5 million acres of land in Western Australia suitable for allocation to agriculture—an area sufficient only to meet the estimated demand from families already settled in Western Australia. Despite this growth, many rural towns were stagnant or decaying after 1945. As motor transport replaced the old pattern of railways largely fed by horse-drawn traffic, the need passed for towns as service centres at intervals of every 15 or 20 miles. Instead, growth tended to concentrate in a few ports or railway junctions, such as Geraldton, Bunbury, Albany, Northam, Narrogin and Merredin. There was a slight corrective to this trend because of modern mining developments in the south-west. The extensive working of bauxite in the Darling Range after 1959 led to the choice of Pinjarra as the site for an alumina refinery, and the working of mineral sands in the south-west during the same period fed the secondary industry of Bunbury. Both these developments, however, gave concern to conservationists because of their influence on the environment, and neither had any major effect on the prevailing trend of population. Following a common Australian experience, the bulk of Western Australians concentrated in the towns, and especially in the Perth-Fremantle metropolitan area.

In the city of Perth the sprawl of suburban growth had been facilitated since the 1890s by the easy availability of timber weatherboards and machine-made bricks for house construction. Like Sydney, but unlike Brisbane and Hobart, brick was more highly esteemed as a building material in Perth. Iron roofing was common in workingclass suburbs, but its tendency to rust led the better off to prefer tiles, at first imported from Marseilles, after the First World War manufactured locally. Streets were planned almost entirely as straight lines or rectangles, although in the eastern suburbs the lines often ran diagonally on a north-west south-east axis following the boundaries of the original Swan River land grants devised to afford as many settlers as possible a river frontage. Curved crescents were introduced between 1911 and 1914 as an innovation in the laying out of Dalkeith and the Mount Lawley Number 3 Estate, but were not widely imitated outside the "prestige areas" (Hope, 1968). The "silvertails" congregated in Peppermint Grove, West Perth, and subsequently Dalkeith Nedlands, suburbs commanding access to Melville Water, King's Park, and similar amenities, while the sandy eastern suburbs, further removed from the ocean and the sea breezes, and in general somewhat flatter than the region between Perth and Fremantle, became predominantly low-cost working-class

residential areas. The provision of suburban railways was totally neglected, except where existing main lines were used to provide a local service; however during the 1890s light lines were built from Midland to serve the orchards and the timber-leases of the Darling Range, and this was a great stimulus to picknicking. The beaches, an alternative source of recreation, were only developed in the Cottesloe-Leighton area served by the suburban railways, until after the First World War the acceptance of mixed bathing and the growing supply of motor-cars and buses facilitated the opening of City Beach, Scarborough, and North Beach.

More than anything else, the provision of an adequate piped water supply transformed the Perth environment. Seddon (1970 and 1972) has shown how nearly all suburban householders eradicated the local flora when they built houses, and instead used their hoses to cultivate trim lawns flanked by beds of largely imported annuals, rose-bushes, frangipani, hibiscus, and other non-natives. Even King's Park, so often extolled as "a thousand acres of natural bush near the heart of the city" remained in that condition only because the trustees, such as Sir John Forrest, lacked the financial means to redeem such a large area from "the drab monotony of the Australian bush" (private communication from Dr P. R. Wycherly)\*; and in any case it soon ceased to be a sample of the pristine flora of the coastal sandplain. It was not until well into the post-World War II period that public taste, perhaps in response to occasional summer water shortages, came to favour the encouragement of native trees and bushes in the suburban environment: just as it was not until then that variants on the conventional red-brick and tile were sometimes voluntarily chosen as acceptable building materials. One noticeable side-effect of Perth's domestic architecture was its influence on the planning of country farm-houses. With return of prosperity after the Second World War farmers who could afford to rebuild their homesteads forsook the old vernacular architecture, with its overtones of makeshift, and built houses in the bush undistinguishable from the ordinary suburban bungalow.

Rapid post-war metropolitan growth provoked a concern for environmental planning. Although Perth had been under a Town Planning Act since 1928 some factors affecting living conditions were little understood. Few foresaw that the establishment of an industrial complex at Kwinana after 1952 might affect the atmosphere of suburbs dependent on the south-westerly sea breeze for summer relief. Transport policy, despite the integration of bus services under the Metropolitan Transport Trust in 1958, failed to solve two major problems. These were the increasing use of private cars and the deliberate concentration during the 1960s and early 1970s of the administrative headquarters of almost the entire business and financial world, together with most State and federal government offices, along one over-crowded mile of

\* King's Park and Botanic Garden, Perth.

high-rise blocks around Saint George's Terrace. A closely controlled policy of land zoning checked inordinate suburban sprawl, but only at the cost of high land prices. Differentiation between the status of suburbs continued to grow, the highest value being placed on those commanding views and access to the river or the sea.

Conscious nevertheless that by most world standards Western Australia was a favoured environment, the community took remedial action. At the official level the destruction of some native fauna was mitigated by the Game Acts of 1874, 1892, 1900 and 1912, and the Land Act of 1898 specifically provided for the creation of reserves for the protection of indigenous fauna and flora: but these early initiatives were not adequately followed up. At the voluntary level some studies of the effect of man on the environment came to be made by such societies as the Royal Society of Western Australia and the Naturalists Club, which although founded as early as 1914 and 1924 respectively, came to shift the focus of their interests in the postwar period (Australian Academy of Science, 1962). In 1959 a concern for the State's early buildings led, none too soon, to the foundation of the National Trust, which carried out useful work in classifying those deserving of preservation. In the same year the State Government took a new initiative by setting up the Swan River Conservation Board, an authority with overriding powers to control the problem of river pollution which had first been noted as far back as 1870. In 1970 the State's legislators agreed to create a Department of Environmental Protection, and in 1971 went further with an Act creating two statutory authorities, the Environmental Protection Authority and Council, with power to report on the implications of proposed new industrial and commercial developments. Controversy was aroused in 1972 when the Authority reported against a proposal to site the Pacminex alumina refinery in the upper Swan, but as alternatives proved to be available, it was hard to argue that the community lost through a concern with environmental factors.

The problems remained formidable. Western Australia—or at least its south-west—consisted of a hinterland increasingly seen as a "big man's" agricultural frontier in which closer settlement, if it came at all, would result only from the chances of mining development or from the deliberately subsidized transplantation of selected industries. The inhabitants of its main centre of population would continue overwhelmingly to seek work and recreation on a narrow coastal sand-plain with a delicate ecology; yet on this basis most experts forecast a population of one million by 1990, and the Lord Mayor of Perth (on evidence as yet unpublished) considered the optimum population to be between 2 and 2.5 million. It would not be easy to reconcile the demands of economic growth with a retention of the quality of life which made Perth, despite its isolation, a fine city to live in.

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